Figure 1

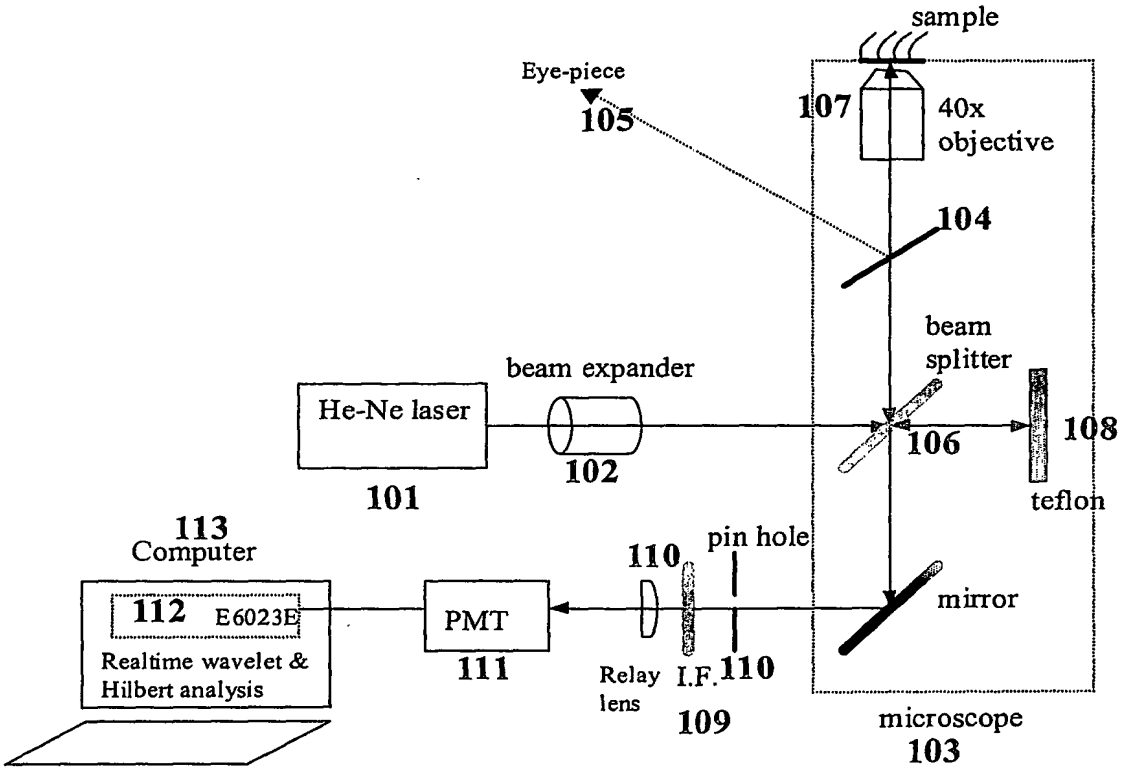

sample
Eye-piece
105
107
40x
objective
104
beam
splitter
beam expander
He-Ne laser
102
106
108
teflon
101
113
Computer
pin hole
110
112 E6023E
PMT
mirror
Realtime wavelet &
Hilbert analysis
111
Relay
lens
I.F.
110
109
microscope
103

Figure 2

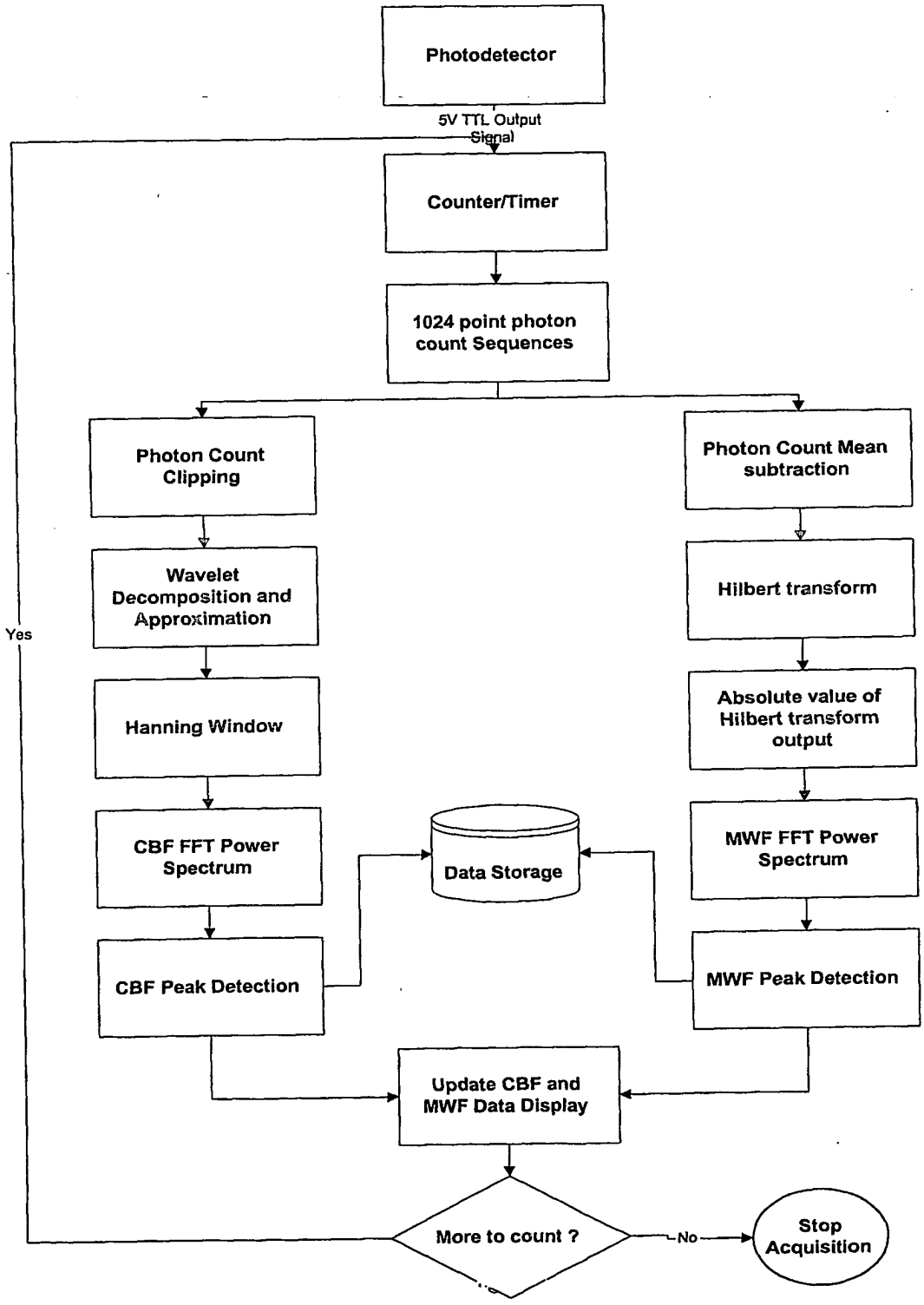
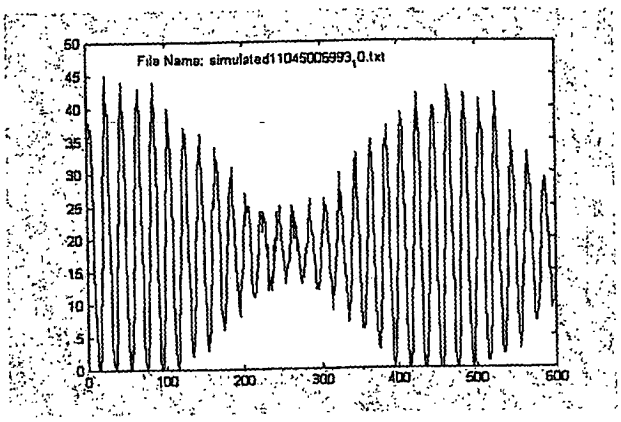
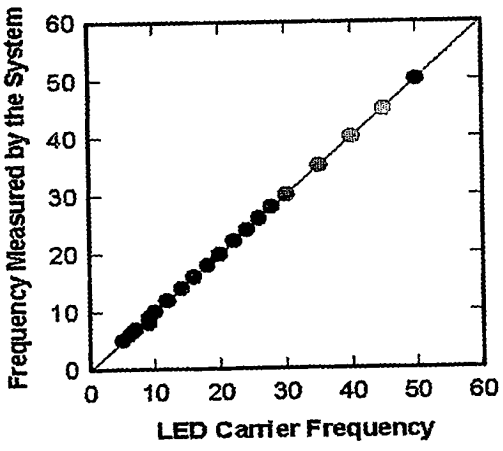

Photodetector
5V TTL Output Signal
Counter/Timer
1024 point photon count Sequences
Photon Count Clipping
Photon Count Mean subtraction
Wavelet Decomposition and Approximation
Hilbert transform
Yes
Hanning Window
Absolute value of Hilbert transform output
CBF FFT Power Spectrum
Data Storage
MWF FFT Power Spectrum
CBF Peak Detection
MWF Peak Detection
Update CBF and MWF Data Display
More to count ?
No
Stop Acquisition

Figure 3

A


File Name: simulated11045005993_0.txt
0
5
10
15
20
25
30
35
40
45
50
0
100
200
300
400
500
600

B


Frequency Measured by the System
0
10
20
30
40
50
60
LED Carrier Frequency

C

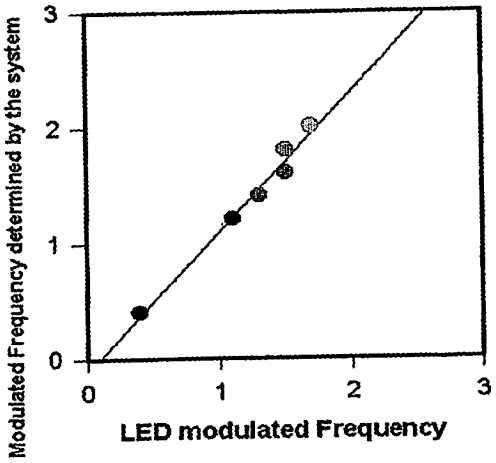
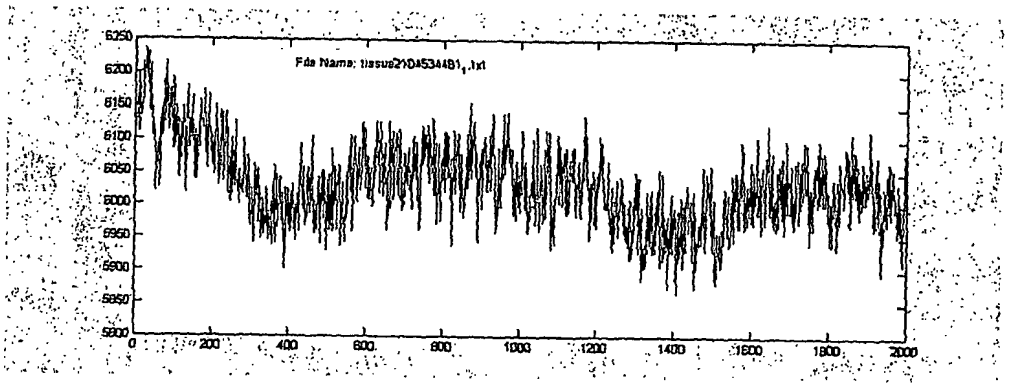
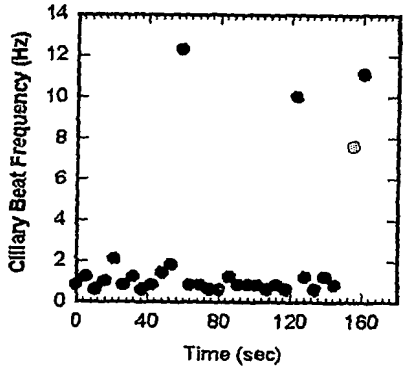

Modulated Frequency determined by the system
0
1
2
3
LED modulated Frequency

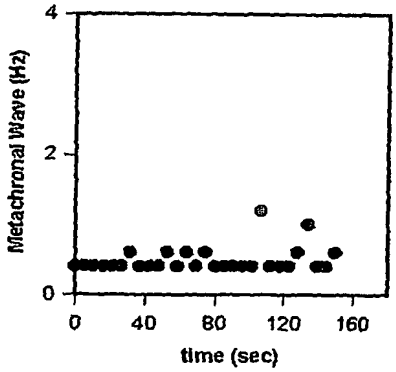
Figure 4

A


File Name: tissue21D45344B1_1.txt
6250
6200
6150
6100
6050
6000
5950
5900
5850
5800
0
200
400
600
800
1000
1200
1400
1600
1800
2000


Ciliary Beat Frequency (Hz)
14
12
10
8
6
4
2
0
0
40
80
120
160
Time (sec)

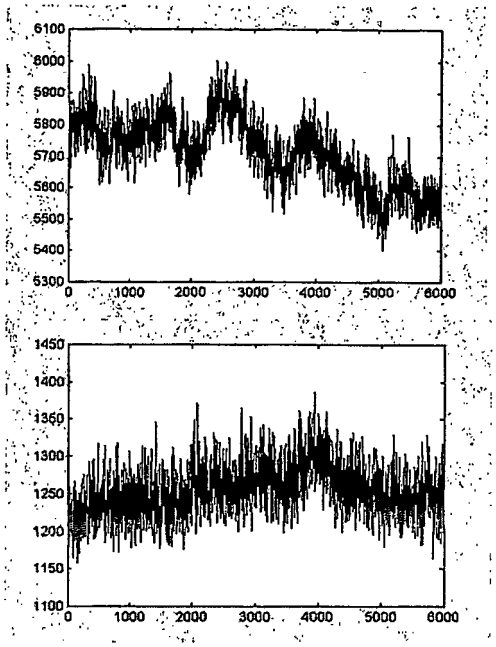
B

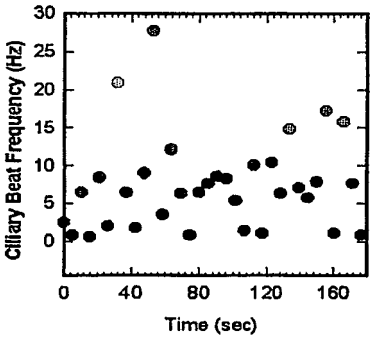

Metachronal Wave (Hz)
4
2
0
0
40
80
120
160
time (sec)

C

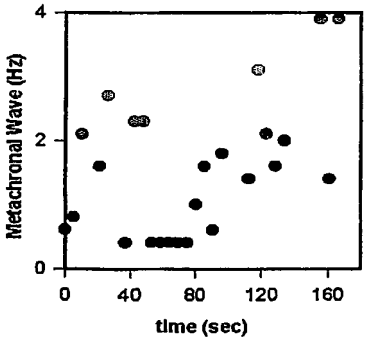
Figure 5

A


6100
6000
5900
5800
5700
5600
5500
5400
5300
0
1000
2000
3000
4000
5000
6000
1450
1400
1350
1300
1250
1200
1150
1100
0
1000
2000
3000
4000
5000
6000


Ciliary Beat Frequency (Hz)
30
25
20
15
10
5
0
0
40
80
120
160
Time (sec)

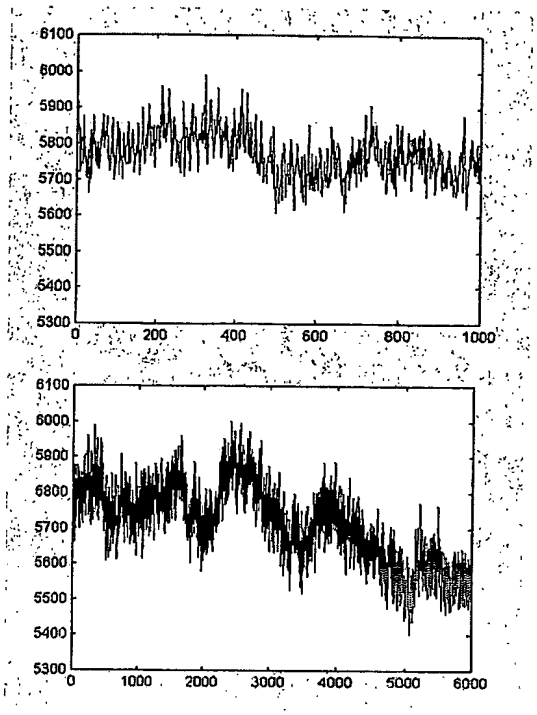
B

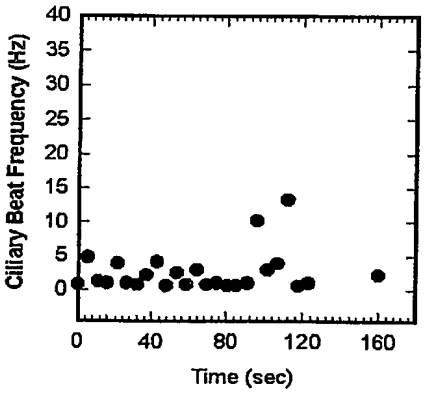

Metachronal Wave (Hz)
4
2
0
0
40
80
120
160
time (sec)

C

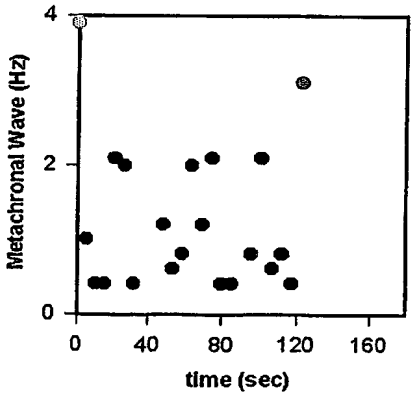
Figure 6:

A


6100
6000
5900
5800
5700
5600
5500
5400
5300
0
200
400
600
800
1000
6100
6000
5900
5800
5700
5600
5500
5400
5300
0
1000
2000
3000
4000
5000
6000


Ciliary Beat Frequency (Hz)
40
35
30
25
20
15
10
5
0
0
40
80
120
160
Time (sec)

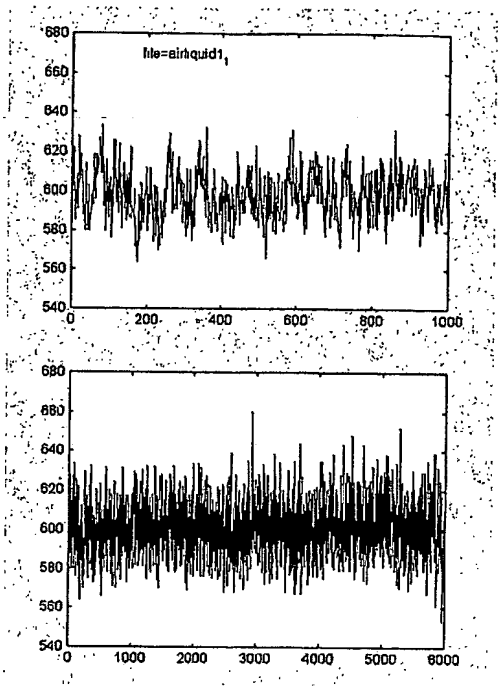
B

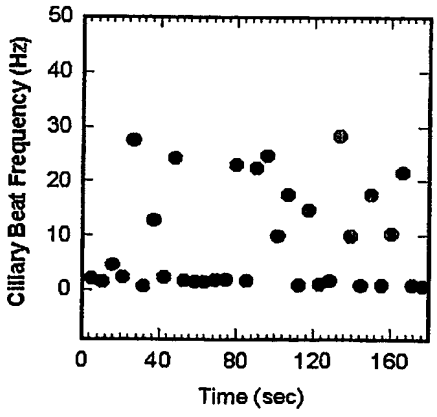

Metachronal Wave (Hz)
4
2
0
0
40
80
120
160
time (sec)

C

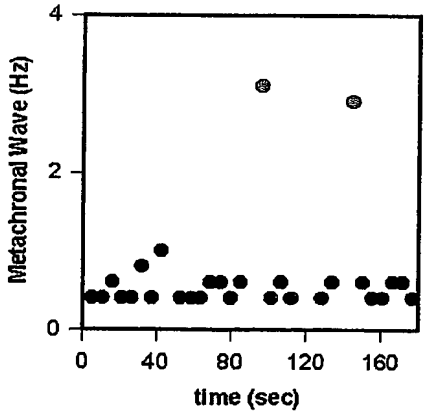
Figure 7:

A


file=airliquid1
680
660
640
620
600
580
560
540
0
200
400
600
800
1000
680
660
640
620
600
580
560
540
0
1000
2000
3000
4000
5000
6000


Ciliary Beat Frequency (Hz)
50
40
30
20
10
0
0
40
80
120
160
Time (sec)

B


Metachronal Wave (Hz)
4
2
0
0
40
80
120
160
time (sec)

C